4 A.M. August 29, subterranean rumblings were followed by two shocks, when a formidable column of black smoke and flaming materials rushed up into the air, and, carried by the wind, fell at great distances, in the form of small scoriæ and sand. Numerous other columns succeeded, with roaring, rumbling noises, lasting for seven hours with great intensity, dying away towards night. The noises ceased on the 30th of August, and vapour and smoke alone rose from the crater and along the line of disturbance.

When the volcanic tremors were most intense, at 4 A.M. 29th August, a fissure appeared on the north side of the great central crater, extending for five kilometers, with an axis running E. by 8° N. The centre of the impellant force was at an elevation of 2,450 metres, between two mountains of lava known as *Fratella Pii* and *Monte Grigio*, where the rent widened to its maximum width of fifty to sixty metres, whence it narrows very steadily towards the base, terminating after a course of three kilometres. And at this altitude, where the greatest thrust was manifested, may be noticed the formation of a new mountain, or crater, with an elliptical contour, coinciding with the fissure in the direction of the axis. It has a diameter of about 100 metres, and covers a superficial area of about 117,734 square metres. This crater, now appearing as a new mountain, is formed of doleritic lava and a pre-historic grey Labradorite, torn from the surface by the black lava of this eruption, in which they are enveloped. There are thus mingled two lavas of the most distant epochs in the history of Etna, the older forming the framework of the mountain. The crater shows internally the usual funnel shape; and near its base, over a width of fifty to sixty metres, there are ten eruptive mouths, open wide, which succeed each other like button-holes;—those nearest the crater are abysses twenty-five to thirty metres in diameter along the line of the fissure. There are also two other groups of small cones, in which the diameter of the mouths is not more than from one to three metres—eight in the second group, and four in the third; so that within a distance of half a kilometre from the crater there are twenty-two minor cones in linear extension. The crack is now continued down a declivity formed by the lava current of 1614, which slopes to the north at an angle of 13° or 14°. Although the rent traverses this lava, there are no more small cones for a distance of 600 metres, when a fourth group of five mouths, each two to three metres wide, is found at an altitude of 2,170 metres; these latter have poured out a torrent of lava descending in a stream 150 metres long, 60 metres wide, and two metres thick. A little lower, at a height of 2,150 metres, is a fifth group of three mouths, more active than the others, but situated like the last group on the great lava stream of 1614. The torrent of lava hurled from these mouths is 400 metres long, 80 wide, and two metres thick, and forms two short bifurcations. Finally, near the end of the crack, at an altitude of 2,030 metres, a sixth and last group of five mouths is formed, which have ejected large quantities of cinder and scoriæ. They are situated about twelve kilometres from the old crater of Mojo, towards which this great crack runs down the side of Etna from its central crater. Besides this principal rent there are an infinite number of smaller clefts, breaking up the soil and radiating from the centres, of great dynamic activity. In a few hours the new mountain and its system of about thirty-five subordinate cones were thrown up, and thus there was brought to the surface a total quantity of about 1,351,000 cubic metres of volcanic materials.

The mingling of the old and new lavas will form the subject of a subsequent memoir. The recent lava, like all modern lavas, is augitic, black, magnetic, and has a metallic lustre. Its specific gravity is 2·3636 at a temperature of 25° Cent. The superficial temperature of the lava was 70°, while at a depth of half a metre it was 90°, and a still higher temperature was recorded where fumeroles were active.

From the remarkably short duration of the eruption, Prof. Silvestri anticipates a more powerful outburst to come, which will be manifested along the rent in making which the present internal explosion has spent its force.

Concurrently with this disturbance the whole of volcanic Italy has been affected. The island of Volcano, after a century of quiescence, discharged cinders and flaming materials from its vast crater for nine months previous to the eruptive phenomena of Etna in the autumn of 1873. The eruption of Volcano continued decreasing in intensity through July 1874, and traces of it are still continually seen. Stromboli last June made a rare eruption, sending out small stones with great energy in place of its characteristic feeble incessant explosions.

Vesuvius has not been unsympathetic, and discharged an unusual volume of dense vapour at the end of August contemporaneously with the eruption of Etna.

## *THE SECOND AUSTRO-HUNGARIAN EXPEDITION TO THE NORTH POLE, UNDER WEYPRECHT AND PAYER*, 1872—74.

On the return of the Austrian North Polar Expedition we gave in NATURE, vol. x. p. 439, an outline of the discoveries made. From the original memoirs on the achievements of the voyage, by Dr. A. Petermann, Dr. Joseph Chavanne, and Dr. v. Littrow, which have been kindly forwarded to us by the first-named, along with the map, we are able to give still further details.

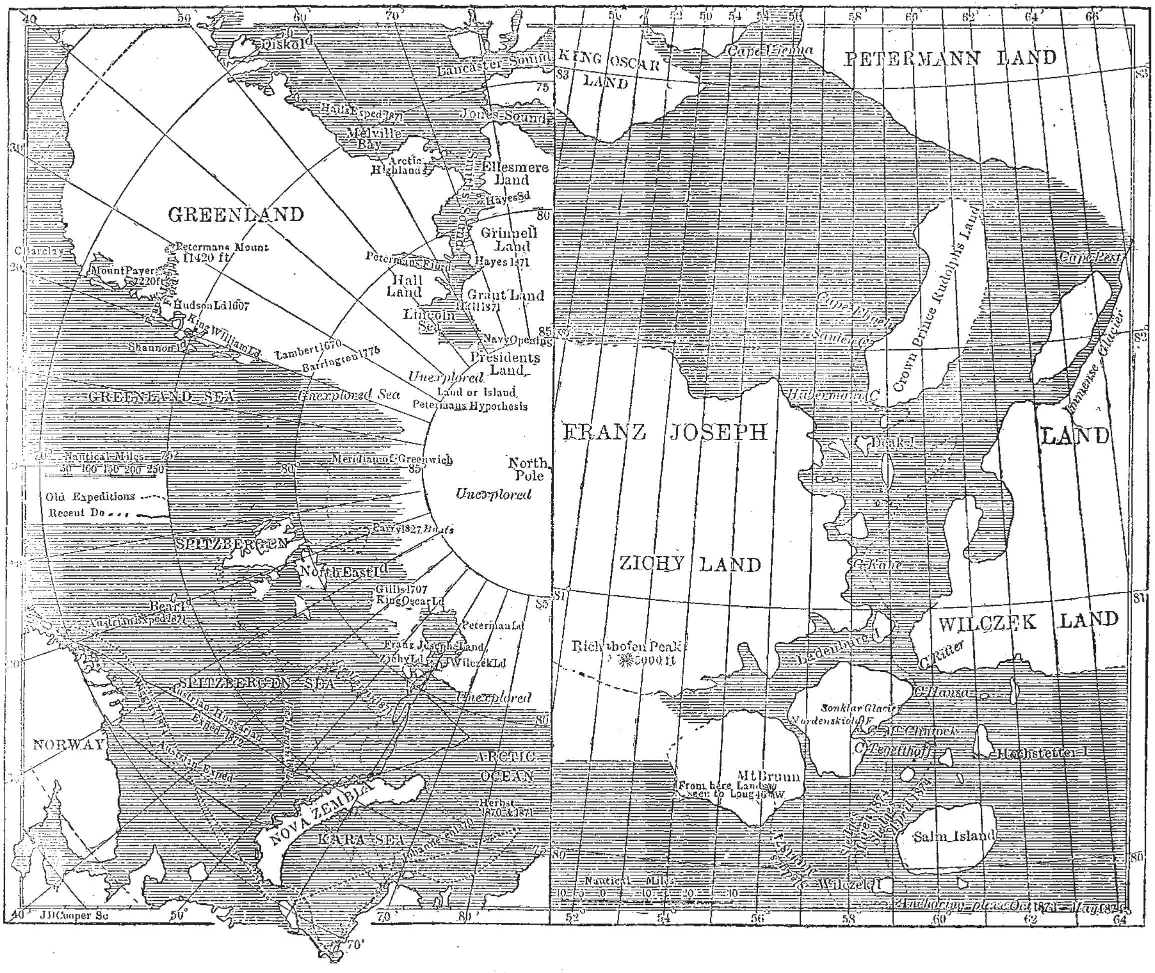
No general with his victorious army returning from battle could have been welcomed with greater enthusiasm and cordiality than this little band of twenty-two men. For though they only come home from a North Polar expedition, people instinctively feel that the accomplishment of the *Tegetthof's* voyage is a heroic deed. To gain a battle, hetacombs of precious human lives must be sacrificed; here all came safely back. A battle does not demand greater endurance and courage, for the battle of the *Tegetthof* lasted two years. We think of the times of Columbus and Vasco da Gama, of their discoveries and return to Palos and Lisbon. It is true the Austrian expedition did not find an America or an India; but Columbus, and other great discoverers, did not really discover more than Weyprecht and Payer. Before Columbus traversed it, men believed that the western ocean was not navigable, and similar ideas prevailed with more reason concerning the sea just explored. One of the first describers of polar regions, Scoresby, had, in the year 1820, in his famous work, drawn a line over the whole sea from Bear Island, in 74½° N. lat., to Novaya Zemlya, and said, with confidence, "Here is the icy barrier where navigation must end;" and the unknown regions beyond this line were regarded by mariners with pious dread. The Austrian expedition has torn away the veil up to 83° N. lat., and has narrowed the undiscovered parts of the earth by a space of 8° to the north.

They had to stay at Novaya Zemlya for four weeks, and work their way out of thick ice for at least 240 geographical miles before reaching Cape Nassau, which was the starting-point of the expedition. They then encountered the most terrific dangers which can befall a polar expedition, for they were hemmed in by an ice floe, and shut up for fourteen months in pack ice, and driven about in the Siberian icy ocean. Eventually a tolerably safe place in the open ice was found for the second wintering, when the crew heroically divided themselves, the better to explore the land they had discovered.

The comrades of the *Tegetthof* have shown themselves worthy to take rank with their prototypes, Ross, Parry, M'Clintock, Kane, Hayes, and Hall, for they have made a breach in a place where no one since Barents, during all the 300 years of arctic discovery, had attempted an attack. The explorations are here shown on a map constructed from the original preliminary sketch by Payer, with the geographical constants drawn by Dr. Petermann.

The nature of the North Pole is not so fully known but that the learned world is still fighting as to whether it is land or water, or an everlasting ice-cap, stretching like our home glaciers, or obeying other laws, or dissolving and opening under the influence of the warm sun, air, or water, like our own seas. And since any expedition can only discover a proportionally small part of the great unknown arctic world, there will always be some people ready with ape-like wisdom to pronounce against any endeavour to unfold the laws of nature within the inner polar regions. Dr. Petermann has for ten years urged that Germany should send out a polar expedition far into the great European polar sea, and is particularly anxious to get the whole breadth of the European North Sea explored from East Greenland to Novaya Zemlya, north of Bear Island.

The results of this expedition have marked an epoch in various ways. First by the drift for fourteen months in the ice-floe. Such driftings have occurred before on a larger scale, as in the case of De Haven, M'Clintock, the *Hansa* people, and the *Polaris* people; but all these expeditions drifted south—the *Polaris* crew from 80° N. lat. to 53°. But entirely new and full of significance for physical geography, is the circumstance that the path of the Austrian expedition was uninterruptedly towards the north.



The map on the left shows the state of polar exploration up to the end of September 1874; that on the right is the newly-discovered land.

The following instances also show that the icy sea is navigable. Hall's expedition north from Smith's Sound proved that from Tessiusak in 73° 20′ N. lat., through the ill-famed Melville Bay, Smith's Sound, Kennedy Channel, Robeson Channel, to 82° 11′, was reached with ease in eleven days, the distance being more than 700 miles; and the best officers of this expedition declare their united conviction that they could easily have reached further north. The Karis Sea, formerly called the Ice-cellar of the North Pole, has proved to be completely navigable. Admiral Sir E. Parry, after Sir James Clark Ross perhaps the most experienced of all polar travellers, going north from Spitzbergen, came to the conclusion that a ship might sail to 82° N. lat. without encountering a piece of ice. Admiral Beechey, one of the most excellent and perhaps the most scientific sea captain who has ever lived, said in 1831 that he considered the navigation of the coast of the arctic region as practicable.

Dr. Petermann then asks: Is the experience of the Austrian expedition a measure of the resistance offered by the ice in the icy sea just explored? Are all the results which are opposed to it, from the former expedition of Weyprecht and Payer, not worthless? Is it worth nothing that numerous Norwegian fishermen in sailing boats have been able to sail round Novaya Zemlya since 1869 and penetrate far into the Siberian ice sea, always finding it navigable and quite free from ice? Is it not worth remembering that at the time Payer and Weyprecht found the unwonted accumulation of ice by Novaya Zemlya, the western half of the great sea, *quite against the rule*, was free from ice, so that the Norwegian fishermen were able for the first time to reach the mystic Gillisland, which is King Charles Land? Under certain unfavourable conditions of wintering, the north side of Novaya Zemlya is, without doubt, as difficult and impossible for navigation as the north side of Spitzbergen, or Cape Horn, or the Cape of Good Hope, or the English Channel, or the mouth of the Weser.

The *Tegetthof* is a small steamer of 220 tons, and though her supply of coal was necessarily small, it proved ample, for steam could only be got up three times in the first three weeks of the voyage. And thus, as in all recent voyages, rowing boats proved themselves better fitted than steam launches for exploring work. In the summer of 1872, the journey from Cape Nassau could not be made in a straight course, but Count Wilczek's journey in the sailing vessel *Isbjörn* demonstrated that it was practicable by following a tortuous course.

The best and first account of the results of the Austrian expedition, in relation to their bearing on the present state of knowledge of arctic geography, and of the current setting into the icy sea from the south, is given by Dr. Joseph Chavanne, and is as follows:—

"The rising polar sun of 1874 lighted up and discovered a new land, now named Franz Joseph Land, and the expedition set off to explore it in sledges. They found the country to be a narrow, far-extending foreland, divided from Greenland by a wide arm of the sea now named Austria Sound. It is mountainous, approaching to a plateau, with steep conical mountains 5,000 feet high, covered with enormous glaciers. This newly discovered land stretches for more than 15° of longitude, and bounds the horizon with mountains as far as the eye can carry to the north and west. In 83° N. lat. they sighted Cape Vienna, the most northern point visible, and Cape Pesth, one degree further south, and finding the great glaciers impassable in this latitude, they returned to their icebound ship. Imperative necessity compelled them to abandon their vessel upon its icy platform, and they set out to return to Europe with four sledges. They travelled on for sixty-nine days, and then fell in with the Russian schooner *Nikolai*, who landed them at Vardoe, in the north of Norway. Austria Sound, and other fjords, were filled with icebergs. They met with no trace of human inhabitants, and remark that animal and plant life is scarce and small in the south."

Twenty-two years ago Dr. Petermann indicated on a map of the arctic regions the polar extension of the Gulf Stream. Though generally regarded at the time merely as the hypothesis of a German philosopher, the unwilling drifting of the *Tegetthof* in the ice has proved that the principal northern branch of the Gulf Stream washes the west and northern coast of Novaya Zemlya. Between the west coast of Novaya Zemlya and the east coast of Spitzbergen, enormous masses of ice press westward with the polar current flowing from New Siberia Island and the Siberian rivers, and penetrate wedge-like into the Gulf Stream. The temperature of Franz Joseph Land in the winter of 1872-73 was 40° Réaumur.

The remarkable correspondence between the coasts on the two sides of Greenland supports the conjecture that the polar land, if not subdivided into a number of islands by ramifying arms of the sea, is at least deeply indented by fjords, as is demonstrated by Hall's discovery of Petermann's Fjord on the west coast of Greenland and Franz Joseph's Fjord on the east.

## PHYSICS AT THE UNIVERSITY OF LONDON[*]

## II.

TURNING then first of all to the Regulations for Matriculation in the University of London, we find that the knowledge of Physics that is required is specified under four heads: namely, *Mechanics; Hydrostatics, Hydraulics*, and *Pneumatics; Optics;* and *Heat*, which last, until quite recently, was included in the examination in Chemistry; and the whole is accompanied by a general qualifying note to the effect that "the questions in Natural Philosophy will be of a strictly elementary character." The particulars, which are given under each of the above general heads, read as if they might have been copied, as they stand, from the table of contents of an elementary treatise on Natural Philosophy published about a hundred years ago. I have examined them often and carefully, and have never found a tittle of internal evidence to show that they were drawn up within the present century; and yet we know that they are the work of a University, not yet forty years old, which owes its very existence to the demand for educational progress, and began its career—without indeed the wealth or the prestige of its older compeers—but also without the trammels of tradition and ecclesiasticism, which render it so difficult for them to advance with the times. It is not a sufficient defence of the antiquated character of these Regulations to say that the very nature of the examination to which they refer would make the introduction of new discoveries entirely out of place, and that, in point of fact, the fundamental doctrines relating to the subjects in question were as fully established a hundred years ago as they are now. This is so nearly true (except in the case of *Heat*), that it would not be worth while to dispute it; but my objection is not to the want of novelty in the subjects enumerated, but to the want of perception, which the manner of the enumeration indicates, of the possibility of progress or improvement in the ways of teaching long-known truths. Instead of giving prominence to general principles in such a way as to suggest to teachers the use of easy and comprehensive methods, these Regulations cut up the subjects to which they relate into a number of detached propositions, of greater or less generality, which teachers and students, who accept these Regulations as their guide, generally treat as independent units of knowledge each of which is to be put into a separate hole of the memory. It would be wearisome, but not difficult, to illustrate my meaning by particular examples; the substance of it is that this examination does not encourage good teaching of the elementary parts of Physics, but induces candidates to trust to memory almost to the total exclusion of any attempt at thinking. My opinions on this subject have not been formed *à priori*, but have been forced upon me by reading examination papers and by trying to teach in what I believed to be the best way. It is in general nearly hopeless to try to get students, who have the fear of the London Matriculation Examination before their eyes, to make any serious attempt to understand the principles of Mechanics; but they often show a lamentable willingness to learn statements of them by heart, and when they go up for examination they know a great deal and understand next to nothing. They know that in a lever of the first kind, whose weight is neglected, the power is to the weight as the weight's arm to the power's arm; that when a heavy body falls from rest, the spaces described in successive seconds are as the natural series of odd numbers; and they are ready at the shortest notice to write down the formula for calculating the specific gravity of a solid body heavier than water; but it is only in the rarest possible

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[*] Introductory Lecture delivered at the opening of the Session of the Faculties of Arts and Laws and of Science, in University College, London, on Monday, Oct. 5, 1874, by G. Carey Foster, F.R.S., Professor of Physics. Continued from p. 508.